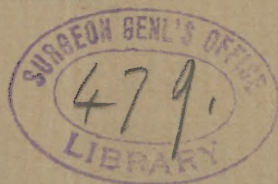


SENN (N.)

*Clinical lecture xxx*



*presented by the author -*

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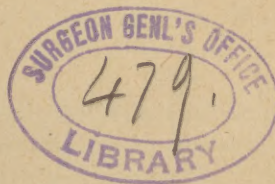
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Clinical Lecture Delivered at the Second Annual  
Meeting of the Association of Military  
Surgeons of the United States.

✓ BY  
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OF CHICAGO.

PRESIDENT ASS'N MIL. SURGEONS OF THE NATIONAL GUARD OF THE UNITED  
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## Clinical Lecture Delivered at the Second Annual Meeting of the Association of Military Surgeons of the United States.

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GENTLEMEN OF THE ASSOCIATION OF MILITARY SURGEONS OF THE  
NATIONAL GUARD OF THE UNITED STATES :

I show you here a case that presents all the characteristic features of tumor-albus, white swelling, with the typical spindle-shaped enlargement of the joint, the largest diameter corresponding exactly to the line of the joint and tapering gradually towards both sides. The swelling here (indicating the point) can be directly traced, not to an effusion into the joint, but to the presence of masses of granulation tissue, as the catarrhal stage of inflammation has subsided long ago, either in consequence of the treatment employed or spontaneously. A catarrhal synovitis is very often the first indication of the existence of tubercular inflammation of the synovial membrane, but often, if left to nature's resources, it gradually disappears and the swelling which assumes a different aspect is then no longer due to an effusion into the joint, but to a thickening of the synovial membrane and the capsule of the joint.

I am told when these incisions were made into the joint, conditions were found that corroborate the diagnosis that I have ventured. I can show you now, if the patient is thoroughly relaxed by the anæsthetic, that the affection has given rise to serious textural changes of the joint; that the tubercular inflammation no longer is limited to the synovial membrane, but has already attacked the deeper structures of the joint, resulting in a weakening of the capsule, so that now, when the patient makes an attempt to walk,



the knee joint bends under the weight of the body, rendering locomotion exceedingly difficult, and the following of his occupation, impossible. I find on examination that the patella rests directly upon the condyles of the femur, that there is but moderate fluctuation in the upper recess of the synovial sac which is always a characteristic feature, either in cases of copious effusion into the joint, or the existence of immense masses of granulation tissue filling this portion of the synovial sac. You notice that the lateral movements are very well marked, showing a decided elongation, and a weakening of the capsule of the joint. I find here, over the outer and inner aspect of the patella, a condition that might be mistaken for a slight effusion into the joint, a puffiness, which extends past the normal depression on each side of the patella, a swelling that presents on palpation, a sensation of fluctuation. It is not a true fluctuation, it is simply a sensation imparted to the finger by a mass of granulation tissue within the joint, a *pseudo* fluctuation, that so often gives rise to serious mistakes, not only in diagnosis, but in treatment. I believe that the most expedient and most conservative treatment that we can suggest in this case is the removal of the diseased synovial membrane, and if necessary, the capsule of the joint. Although the patient is fifty years of age I feel that I am justified in making a conservative effort in saving his limb. At the same time, I wish to choose an operation which will remove all the diseased tissue. I propose to make, in this case, an arthrectomy or resection of the joint.

Arthrectomy was devised by Volkmann, and recommended by him in all cases in which the synovial membrane is either primarily or secondarily involved in the tubercular process, and where the pathological lesions in the extremities of the bones, are such that a typical resection can be avoided. It is becoming more and more the favorite operation, to limit our efforts to the removal only of diseased tissue, and save as much as possible of the other joint structures, hence, I think in the treatment of tubercular joints, the operation now almost invariably selected, where the disease is not very extensive, is either arthrectomy or atypical resection. I am quite confident, that in this case the disease does not seriously implicate the articular

ends of the bones involved in the formation of the knee joint. The first thing that we do is, to mechanically empty the blood vessels of the affected limb, not by an elastic bandage, because I would be fearful that by making an elastic compression from the periphery of the extremity up to the diseased joint and beyond it, that with this means of rendering it bloodless, it might become the direct cause of the dissemination of the tubercular process. The mechanical compression may result in furthering the work of the disease in the joint, and force the tubercular process into the circulation, hence it might become the direct source of a general or a disseminated tuberculosis. I believe that the elastic compression of the extremities is not only superfluous, but exceedingly dangerous. All that is necessary is simply to elevate the limb and keep it in this position for a few minutes. Lister's experiments on the lower animals show, that even in a large animal like the horse, by elevating the limb you can cut the tibial artery without much hemorrhage occurring. We have drained the limb of the venous blood by elevating the limb, we have diminished the arterial force of the circulation by the same means and are now ready to at once cut off the circulation of the limb to be operated upon by the elastic constrictor. I wish to call your attention incidentally to this means of preventing hemorrhage, that even elastic constriction must be practiced carefully in order to prevent remote, and often serious, consequences. It has happened to me on two occasions, perhaps, by my own carelessness, in resorting to this simple surgical measure, that I have produced in one instance paralysis of the musculo-spiral nerve, that gave me great anxiety for three or four months, and in a second case, in operating upon the leg, making constriction immediately above the knee joint, paralysis of the peroneal nerve followed, from which the patient has, even now, not fully recovered. I therefore insist that in using the elastic constrictor, it should be applied invariably at a point at which the principal nerves of the extremity are safely protected by a cushion of muscular tissue. (Constrictor applied.) Never apply the elastic constrictor, if you can avoid it, for instance, to the part where the musculo-spiral nerve passes almost sub-cutaneously



over the shaft of the humerus; when this has to be done on account of the location of the disease, interpose between the constrictor and limb a thick layer of gauze. The next thing to avoid is linear compression of the deep important structures. I am very sorry indeed that I have now an elastic constrictor that is not very well adapted to avoid linear compression. I should much prefer to use a bandage instead of a tube, to make the compression as diffuse as possible. An elastic constrictor should be at least an inch or an inch and a half in width. We will use in this case the ordinary elastic roller. (The constrictor broke, whilst the doctor was making the constriction.) The constrictor has lost its intrinsic elasticity, I therefore shall have to use a rubber tube, but I will apply the tube in such a manner as to diffuse the compression as widely as possible. Apply the tube at several points in this manner (indicating), so as to obtain a wide surface pressure. One other matter to be considered in applying an elastic constrictor, is, to make the compression suddenly, so as to interrupt the circulation at once. A slight application of pressure, or a slow application results in venous stasis. I believe that we have a comparatively bloodless condition of the limb in this case, and are now ready to proceed with the operation. One of three incisions is usually selected now, in making a typical arthrectomy or an atypical resection. There are few surgeons who make the old horseshoe incision with the convexity of the flap directed downwards. There are two serious objections to this incision. The resulting scar of such a resection wound, falls in a place where it is later most exposed to injury. Volkmann's trans-patellar incision is an improvement upon the old incision, but is again open to objections, because the lines of the incision of the soft parts and the sawn surfaces of the patella correspond. The result is an adherent scar, sealing the soft tissues to the anterior surface of the patella, hence, I select the semi-lunar incision, with the convexity not directed downwards, but upwards, making the trans-patellar section in the same manner as Volkmann, thus we have a large flap, which, after suturing, renders the line of the suturing of the patella sub-cutaneous.

Incidentally, before we make the incision, I will call your attention to these three scars that I have pointed out to you



before; they are characteristic tubercular scars, scars that are even now manifest, long after the operation was made, still remain exceedingly vascular, scars showing only too plainly that the primary cause of the joint affection has reached the scar tissue, interfering with the normal avascularization of scar tissue. In some cases, where there is some doubt about the nature of the primary affection, the condition of the scar will often lead you in the right direction, in making a correct diagnosis. I will now commence the incision over the inner aspect of the knee joint, exactly over the most prominent point of the internal condyle, and extend it in a gentle curve from this point to about an inch above the upper border of the patella. I select as my landmark for the termination of the external incision, the most prominent portion of the external condyle, and carry the incision in a second gentle curve across the swollen synovial sac, near its upper recess carrying it again downwards, terminating it on the opposite side of the knee at about the same level. I have now completed the semi-lunar incision with the convexity of the flap directed upward. Its upper border reaches about an inch above the upper margin of the patella. I now reflect this flap, turn it downwards, being careful to take with it the other tissues down to the deep aponeurosis so as to preserve as many of the sub-cutaneous blood vessels as possible. I will separate the flap downwards to a point just below the lower border of the patella, exposing the patella. I am ready to make a trans-patellar incision, dividing first the soft tissues on either side. I saw through the patella transversely, about the middle. I now divide the ligaments of the knee joint on each side, and am ready to give the joint a very careful inspection in order to make a positive pathological diagnosis. You now look into a typical tubercular joint, with very slight affection of the articular ends of the bones, but quite an extensive destruction of the articular cartilage. Our diagnosis has therefore been corroborated by direct inspection of the joint. I must now make two additional incisions one on each side of the upper fragment of the patella, in order to expose fully the upper recess of the joint, to enable me to remove the diseased capsule, thoroughly. Notice how much the capsule of the joint has become thickened, the disease, as I predicted, is no

longer limited to the synovial membrane, it has extended to the capsule, which accounts for the preternatural mobility of the knee joint laterally, as we ascertained before the operation. I must, therefore, make a typical arthrectomy of the soft structures of the joint, an operation which is always somewhat tedious, but which, in order to be successful, must be thorough. As the patella presents no evidence of disease, I believe it is safe to leave this structure, and limit our operation to the soft tissues of the joint. You notice a most interesting pathological condition at this point, a mass of cicatricial tissue which seals down the anterior wall of the synovial sac to the posterior; it is an intra-articular scar, presenting an unmistakable evidence of the recuperative power of nature's resources, an attempt not only in the arrest of the disease, but even a well marked indication of a curative process. Tubercular joints occasionally will get well spontaneously, but only too often, the best result that can be expected, as you well know, is either a partial or complete ankylosis caused by such an intra-articular scar.

I now dissect out carefully the upper recess of the joint, which I can do very readily by lifting up this central flap that I have made. In making this dissection I am exceedingly careful to carry my incision as far as I can determine through healthy tissue. It is the clearing out of the upper recess of the synovial sac, that in the old operation with the convexity of the flap directed downwards, is so imperfectly done, and that accounts for the many local relapses after such operations. I show you here a typical tubercular capsule. Haste in this part of the operation should be made slow, as the removal of the capsule requires a tedious dissection. The prime indication in this part of the operation is, to remove all of the diseased tissue and to preserve as much as possible of the healthy structure of the joint. As we predicted, the capsule is very extensively diseased, making its complete removal a matter of necessity and not of choice. I reached this copious cushion, of what appears as healthy, para-articular fat. As I have no use for this structure, and as it may be the seat of an incipient infection, I have no hesitation in removing it with the diseased capsule. I wish to



clear the condyles of the femur thoroughly as though I were to make an anatomical preparation, hugging the bone very closely, as I remove the tissues from the intercondyloid notch and all around the condyles. We have now cleared out the upper recess of the synovial sac, very thoroughly, and are ready to attack the joint surface. I now proceed to remove the synovial membrane, and the diseased capsule over the outer aspect of the joint, and clearing at the same time the articular surface of the tibia, taking again the same precaution to hug the lower surface of the patella and to reach the remote corners of the joint. You notice that here between the condyles, what remains of the crucial ligament presents about the same appearance as the diseased capsule, necessitating the complete removal of this structure. It is here on the sides of the joint where I have to make the arthrectomy again very thorough. The capsule here again is thickened enormously. I have so far made no use of the sharp spoon. I am not making what English surgeons are pleased to call an erosion, I prefer to make a typical arthrectomy including the removal of the synovial membrane and the capsule. To make a typical arthrectomy, it is unsafe to allow any part of the lateral portion of the capsule to remain. I now reach a part of the joint, presenting the greatest difficulty in making an arthrectomy, the space behind the condyles and the head of the tibia. We will use the arm of one of our assistants as a fulcrum in the popliteal space, over which I will now bend the knee, so as to render this part of the joint more accessible. I am reaching now, as you all are aware, a dangerous neighborhood. The large blood vessels are always a bugbear to the operating surgeon, a hair's-breadth of tissue between them and the operation wound often will make a great difference as to the immediate and remote outcome of an operation. I remove every vestige of the crucial ligament and the posterior part of the capsule without endangering the popliteal vessels which I am very anxious to avoid. As I have removed the entire capsule very thoroughly, the best result that I can expect in this case will be ankylosis with the limb in a good position. The articular cartilage has been worn away, destroyed by the extension of the disease from the synovial membrane, to this structure. In clear-

ing the articular surfaces I have to abandon the use of the knife; I cannot dissect away the cartilage in the same manner that I dissected away the capsule of the joint, I do not wish to use the saw, as I promised you not to make an atypical resection, and yet, I must clear out of the joint all of the tubercular tissue; I will now make an erosion of the articular surface of the knee joint; I will scrape away the articular cartilage. Unfortunately the spoon I am working with is better adapted for scraping sinuses than to remove the articular surface of the femur and tibia. The instrument I prefer for this purpose is a large shallow spoon. I can do this part of the operation well with this spoon, but its use necessitates a little unnecessary loss of time. Never rely upon the spoon in removing a tubercular capsule, this part of the operation must be done with a more thorough instrument — the knife. I have not used as yet, as you have observed, another instrument that is so frequently used in this operation, scissors. I prefer the knife to the scissors, because I can with it make my incisions with more precision and thoroughness. I now wish to flush the joint with a strong aqueous solution of iodine, a solution that I invariably employ in operating on tubercular lesions. The effect of iodine on tubercle bacilli is a decided one, and can be relied upon much more than corrosive sublimate or carbolic acid in operations for tubercular lesions as both of these antiseptics have no decided antibacillary effect. At the same time, the iodine solution produces another effect on the tissues that is of great use in operating for tubercular lesions. It has a decidedly stimulating effect on the tissues exposed by the operation, initiating at once an active process of repair so useful in the prevention of a local recurrence. There are still remaining on the wound surfaces small fragments of tissue that may still harbor the essential cause of the disease that a stream of water will not remove. I wish to rub away with a small antiseptic compress, preferably iodoform gauze, the fragments of tissue entirely or partly detached, so as to supplement the means which we have resorted to in the mechanical removal of the diseased tissues, by this simple and yet exceedingly important measure. I now wish to iodoformize thoroughly the wound surfaces, by sprinkling them with iodoform; most of which of course will



again be removed by rubbing with the small compress of gauze. I wish to bring this valuable antibacillary agent in immediate contact with the tissues that have been so close to the infective process, adding to the mechanical measures a chemical means of destroying, or rendering harmless, all that still possibly might remain of the tubercular disease. We have now completed the arthrectomy. I now ask for a large compress with which to make surface pressure, in order to reduce to a minimum the amount of parenchymatous oozing, which will follow the removal of the elastic constrictor. I believe it is a mistake in theory and in practice, after operating on such a large joint, and so extensively as in this case, to rely upon suturing in arresting the hemorrhage. I will ask one of the assistants to remove the constrictor while I am making surface pressure. You are all aware that valuable as the elastic constriction is in the prevention of hemorrhage or its treatment, that the very means which we resort to in diminishing hemorrhage during an operation, unfortunately often gives rise to serious parenchymatous oozing after the removal of the constriction, on account of a temporary parietic condition of the capillary vessels caused by the constriction. It is a well-known clinical fact that parenchymatous oozing is much more marked and more difficult to manage after elastic constriction than by operating without taking this precaution. Compressing the surface for a few minutes, I resort to the best known measure to prevent this undue amount of parenchymatous oozing. I desire in this case, to obtain, if I can, perfect hemostasis, I wish to arrest the hemorrhage thoroughly and completely before I suture the operation wound. I hardly believe that it will become necessary to apply more than one or two ligatures, to some of the articular branches, as I have been careful not to injure any of the important blood vessels in the immediate surroundings of the knee joint, and while the assistants are now taking care of the bleeding points, I will utilize the time in drilling the fragments of the patella, in order to enable me to approximate the fragments by suturing. The only suture necessary to keep the parts in apposition until union by a bony callus takes place, is catgut. I am satisfied that any fracture of the patella can invariably be brought together, and success-

fully united, by relying on the catgut suture. I am exceedingly anxious in a case of this kind, that no foreign material shall be allowed to remain, because I am operating for a pathological condition, and any foreign substance being allowed to remain within the immediate vicinity of the knee joint, might become the means of lighting up a latent tubercular process at any time in the future. I therefore desire to use a suture that will be absorbed, after its presence has been made unnecessary. Evidently St. Louis favors the use of an artificial finger, the assistant here has handed me a needle threaded with a catgut suture in a needle holder. I simply wish to enter my protest against the use of this occasionally very useful instrument, wherever it can be avoided. I believe the best needle holder, and one that never is out of order, one that can be rendered aseptic, and should be asepticized before a wound is touched, is the hand. I wish to make a double suture, with one thread. I therefore have proceeded by passing the suture through the outer side of the patella. I now drill the second opening in the lower fragment, about an inch from the first. The assistant will now watch his chance to follow the perforation as I remove the drill. I make a small opening in the upper fragment, and I hope that we will not lose quite so much time. I have now a double suture of durable chromacised catgut in place, and I am ready to bring the sawn surfaces in accurate apposition by tying the suture.

In operating for tubercular affections of joints, it is exceedingly important to classify the cases according to the pathological conditions — pure tubercular affections, and tubercular affections complicated by secondary infection with pus microbes. I maintain that this classification is important, because in operating for mixed infections, with few exceptions, we fail in obtaining a union by primary intention. On the other hand, in operating for purely tubercular affections, we are brought face to face with a condition which, if we eradicate thoroughly, we can confidently expect what we should aim at, primary union of the wound throughout. I make this distinction simply to introduce my remarks on drainage in operation wounds made for tubercular lesions. If I had here a joint communicating with the outer



surface by means of suppurating fistulous tract, I should certainly feel that I should not do justice to the case, if I closed the wound throughout, because in all probability, I should be unable to remove the primary pathological conditions of both forms of infection. I believe, that in this case, even if tubercular tissue has remained, there is absolutely no indication for securing drainage. Open tubercular lesions are always more dangerous than sub-cutaneous lesions. The sooner, therefore, this wound heals, the better for the patient, it is therefore my intention to close the wound throughout, but to establish a drainage for a few days only, in order to avoid tension upon the flaps, by inserting a few strands of catgut at the lower angle of the wound a drain that will not necessitate an early removal of the dressing, which can never be accomplished without some disturbance of the wound surfaces, a drain that will be removed in the course of five or six days, after its presence is no longer desirable, after it has fulfilled its object. This drain will lead away from the wound surface into the absorbent antiseptic dressings the excessive primary wound secretion, which of course will place this wound in a condition of absolute rest, so much to be desired in operating upon tubercular patients, that invariably are not only suffering from this apparent direful pathological condition, but are tubercular patients in every sense that that word implies. We have now arrested the hemorrhage, as you notice, but I am anxious that the limb should be kept in an elevated position, in order to bring the blood vessels in the most favorable condition for the establishment of a collateral circulation, adequate to the requirements in this case. Now by drawing upon the ends of this double suture, you will notice how gradually the sawn surfaces are brought into approximation, no need of silver wire, no need of any other form of durable suture, the absorbable catgut suture here, will keep the parts in apposition, until its further use has been made unnecessary by the plastic process that will be initiated at once and terminate in bony union. We have now the patella in place, we have here a double bridge composed of absolutely healthy tissue, a bridge that will add strength to the weakened member at the site of operation, a bridge that will prevent the retraction of one of the

most important muscles of the lower extremity, the quadriceps extensor femoris muscle, a bridge that will add its part to the process of repair at the site of operation. We will now suture what remains of the capsule over the joint on each side, in other words, we are ready to close the deep wound with buried catgut sutures. I am ready now to close the deeper portion of the wound which embraces all that it was deemed safe to preserve of the deeper, para-articular structures. What I wish to call your special attention to, is the relative position of the external incision to the line of section of the patella, the first occupying a level about two inches higher than the other, hence the section through the patella is covered by the flap; it has been rendered sub-cutaneous by this method of making the incision. I have to entertain no fear that the skin covering will become permanently attached to the line of bone suture. I have secured for the anterior surface of the patella perfectly healthy tissue. The scar that will necessarily result from the operation, will be in a well protected place, it will not be exposed to prolonged, continuous irritation, incident to locations previously selected. Witness with what ease the assistant is suturing the external wound, with a facility never within reach if you make the old-fashioned incision with the convexity directed downward; hence, I would advise in all operative treatment, requiring full exposure of the knee joint, a semi-lunar incision with the convexity directed upwards, the margin of the flap about an inch above the upper border of the patella. You are aware that the advice is given, even at the present time, the assertion that in operations for tubercular knee joints, it is not only desirable, but necessary to remove the patella; we have no reason to exempt the patella from the general rule that is becoming, or has become an axiom in general surgery, to remove only diseased, never healthy tissue. I have pointed out to you the uses of this long bridge in resection of this joint. It is necessary in such an extensive operation, to apply over this large wound a very copious hygroscopic antiseptic dressing. We have, I hope, guarded sufficiently against primary wound infection, it is now our duty to protect the patient against such an occurrence in the future, and the less the wound



is disturbed, and the least number of times it becomes necessary to remove the dressing, the greater the possibility of obtaining an ideal wound healing, in fact, I hope that we have left the parts in such a favorable condition, that this wound will heal under one dressing. It is my hope that no indications will arise, necessitating the removal of the first dressing, for at least three or four weeks. We can hardly expect with a man of his age, although we have been exceedingly conservative in the removal of the joint structures, that we can obtain anything else but healing by partial ankylosis, in fact, it is my intention, rather, to favor this termination. If the patient were only 15, 20 or 25 years of age, I should make a faithful effort after such an operation to restore motion after the external wound is healed, but in a man at his age, anxious again to follow his occupation, to support himself and family, it is our duty to initiate such a course of treatment as will enable him to leave the hospital in the shortest space of time, with a limb in a condition to render himself again useful in the community, hence the limb will be placed in a slightly flexed position, in fact, the patient is intelligent enough to have called my attention to the fact that he did not desire a perfectly straight limb, he desires a limb slightly flexed, a wish which meets with my hearty approval. We will now secure for this limb then, a desirable angle, and at once immobilize it in a permanent, fixed dressing of plaster-of-Paris. The assistants will now envelop the limb in a thick layer of aseptic cotton from the periphery up to the groin, which will provide a soft, yielding cushion to protect the soft tissues, and which will guard against harmful compression in the event that we should have failed in obtaining all the essential conditions for primary wound healing. I hardly believe, gentlemen, that we have as yet found a desirable substitute for the old plaster-of-Paris dressing, that is the dressing that will be used in the wars of the future. It is the dressing that fulfills all the indications, securing to perfection immobilization of the injured parts, a dressing that can be so readily applied, a splint that adapts itself to all irregular surfaces. It is therefore a splint that if properly applied, is the best and the safest safeguard against peripheral gangrene and localized pressure necrosis.

The limb will be kept in an elevated position, at about this angle (indicating), for at least six or twelve hours, an exceedingly important precaution in preventing unnecessary parenchymatous hemorrhage after such an extensive operation.

AMPUTATION OF RIGHT THIGH, LOWER THIRD, BY GENERAL SENN.

GENTLEMEN: We have just finished, what you will all admit to have been a very conservative operation, for a life-destroying serious joint affection in a man 50 years of age. I am very sorry indeed that the conditions presented in this our next patient, although he is younger in years, render it necessary this morning to make a mutilating operation, for the same pathological conditions, but affecting two great joints instead of one. It is not necessary for me to make any extensive remarks to justify my diagnosis in this case, as tubercular disease of the ankle and knee joints. The case is an exceedingly interesting one from an aetiological standpoint, illustrating over and over again what we have claimed for years, the infectiousness of tuberculosis, the disease commencing in this instance in the same insidious manner as in the one which has just left the arena. The disease of the ankle joint, commenced after a simple innocent sprain, followed, however, by an insidious tubercular affection, which has now reached its maximum destructive effect, having resulted in complete destruction of the soft structures of the joint, and as is evident by exploration of the joint with a probe, it has extended beyond the cartilage, into the articular extremities of the bones entering into the formation of the ankle joint. In fact, here is a case of so-called caries, which is in reality an effect of disease, not a disease *per se*. Caries of bone is produced by molecular destruction of bone tissue by granulations and is in ninety-nine out of a hundred cases, the result of a tubercular inflammation. I was encouraged when I was asked to examine this patient, to make for you this morning a conservative operation on the ankle joint, I had already decided to make a typical resection of this joint,

when my attention was called to the knee joint, where I found all of the pathological conditions which warranted me in claiming for it a similar origin and character, as the affection of the ankle joint. To us, it is an exceedingly important matter to discuss the ætiological relationship existing between the disease of the ankle and the knee joints. I believe that in this case, there is absolutely no direct ætiological connection between the ankle and between the knee joint affections, but the infection of the knee joint can in all probability be traced to the same focus that primarily produced the disease of the ankle joint. There is great danger that in this case, with two tubercular joints, the seat of secondary infection with pus microbes, the patient would soon become the victim of pulmonary tuberculosis, tubercular meningitis, or even of disseminated miliary tuberculosis, if the peripheral lesions were allowed to pursue their own course, hence, in order to meet the pathological conditions, it becomes necessary for us to sacrifice the lower limb and make the amputation through the thigh, eliminating by the same operation the two tubercular joints. It has been my custom for years, never to burden the student's brain with names attached to operations immortalizing distinguished surgeons, important as these things may be from a historical stand-point, they are useless in practice. There are only a very few essential principles that become necessary to memorize and to carry into effect in amputating through any part of the lower or upper extremities. If you will remember that it is very important to make the incision in such a manner as to bring the resulting scar away from pressure in wearing an artificial limb; if you will remember that it is quite essential in order to secure an ideal result in all amputations to preserve the periosteum and in order to prevent a common and very painful affection, neuroma, that the principal nerve trunks should be cut off at least an inch above the level of the incision through the deep soft part; and if you will not forget that it is important under all circumstances to secure complete hæmostasis, you have all the essential rules that should guide you in making an amputation anywhere. Hence the names so frequently attached to the many different operations, names that have



made the student's life a misery and their practice often a failure, do not deserve as much attention as they have received in the past.

The operation that I am just about to make, through the thigh, may be regarded as a type for any amputations of the upper or lower extremities. In order to throw the scar away from where it will do harm, it will be necessary to make one long and one short flap, whether you take a long flap from the front, from the side or from behind is immaterial, you will take tissue where you can obtain it, you will make the amputation as far away from the body as possible.

It makes my blood curdle and my hair stand on end when in the 19th century, during this progressive age, men are held up in courts of justice to answer a malpractice suit for having made perhaps a posterior long or a lateral flap, but old text-books are still revered by lawyers, but they are of little use to the surgeon. If called upon, under such circumstances, do not hesitate for a moment in supporting your colleague, whether he has made a long anterior or a long posterior flap. Rest assured that if he is a progressive man he has taken the flap from the region best adapted to serve as a covering for the stump. (Applause.) Here, fortunately, we are in a position where I can take the flap from where it is most desirable to take it. I wish here to make a long anterior flap, which is the ideal flap, of course, or drainage to the wound, and as you will notice, the flap by its own weight will seek and maintain its proper position, at the same time securing the best conditions for efficient drainage. If the knee joint had formed sinuses I should have found the tissues over the anterior aspect of the knee joint in a favorable condition for a flap than on the opposite sides, I would have no hesitation in transgressing public opinion and would make a long posterior and a short anterior flap, I should then come to the rescue of the flap and instead of relying too much on gravitation in keeping the flap in place, I would furnish it with proper mechanical support by suturing splints and careful bandaging and establish drainage by making a button-hole in the center of its base. Here then, if I am to use names that will for all

time to come be associated with an amputation that will yield an ideal and useful stump, I must mention one man above all others, Bruns, the late distinguished professor of surgery at Tübingen, who advocated a long anterior and a short posterior flap in amputation for trauma or pathological conditions wherever his rule can be applied without violating the laws of pathology. I wish I could make here a lower amputation, and demonstrate to you Carden's transeondyloid amputation, but unfortunately we have to remove not only the knee joint but the tissues some distance above it, we must, therefore, necessarily amputate above the condyles. I have carefully examined the cutaneous covering, and believe I can make an anterior flap reaching down at least to the upper border of the patella, without running any risk of including in the flap any of the tubercular tissue, and I will therefore follow the rule that should never be violated, the same as in resection, of not removing, unnecessarily, healthy tissue, even in making a mutilating operation. We will use the same means to control hemorrhage during the operation as in the last case, and will again resort to elastic constriction which here must be applied very high up. Having made a long anterior and a short posterior flap I will divide the remaining soft tissues with a long knife, and make the incision a little conical, the apex of the cone directed upwards. I now make the last cut, a circular incision through the periosteum about two inches below the circular incision through the muscles, in order to enable me to obtain, not only for the soft tissues, but for the bone itself, its normal envelope. I will reflect here, as you notice, the cuff of periosteum with the same care as I would make the flap for the soft parts, because as far as the immediate risks of traumatic infection are concerned, this material is of more importance than the remaining deep structures of the limb. I will now saw the bone through in such a way that the sawn surface will be on a higher level than the section through the soft tissues in order to prevent undue prominence of the bones in the stump so that the patient can wear an artificial limb, with comfort. The end of the bone as you observe, is even, but there

are sharp edges left, and if these were allowed to remain they would become the cause of much trouble, consequently I chip away these sharp margins with bone forceps in order to protect the periosteal cuff against the harmful effect of linear pressure. You notice the periosteal cuff will be abundantly long to supply the cut end of the bone with its normal covering. I wish to isolate and tie the arteries separately and in a second ligature about one-third of an inch higher up I shall include the accompanying veins. I believe it is very important for us to place the vessels in a condition best adapted for closure by cicatrization in the shortest space of time. In ligating a large vessel, it is important always to use ligature material that will be removed by absorption, an absorbable ligature cannot be excelled, and I believe we have overdone the last few years in the way of using silk ligatures, which to me, have often become a source of great annoyance, and more so to my patients. A silk ligature that fails to become encysted in a suppurating wound, is always a source of mischief. I have now applied one ligature, the next ligature shall include not only the artery but also the accompanying veins. I am tying with a double ligature the second one of which includes also the veins. The bloodless space in the artery, 4 to 7 days, becomes closed permanently by granulation tissue. We will now seek for additional vessels, muscular branches, if any of them can be found and tie them before the constrictor is removed. I am now looking for the sciatic nerve, which I find here, buried in this mass of fat. It is extremely important for to remove at least an inch or two of this nerve in order to prevent the development of a painful neuroma later a frequent sequela of amputations unless neurectomy is practiced, a source of much pain to the patient and chagrin to the surgeon. Such a complication seldom or never sets in if the nerve end does not remain in the scar of the amputation wound. You will always find the neuroma involved in the cicatricial tissue. We have ligated the large vessels, we have resected the nerve, and we will resort to some means of arresting unnecessary parenchymatous oozing. I will see, however, whether the flaps are as they should be before we go any further, because now would be the



time to correct any mistakes as to the length of the flaps. You see the anterior flap falls down into its natural position, there will be no tension, I have made the flap about right as far as the length is concerned. I will compress the surface of the wound firmly with a gauze sponge for a number of minutes, after removal of Esmarch's constrictor, in order to prevent unnecessary loss of blood. In patients debilitated by such an extensive tubercular disease, as in this case, not a drop of blood should be wasted unnecessarily. The assistant should be ready with hamostae forceps, as I am about to remove the compress, to catch any spurting points that may be seen, all of which should be ligated, after which compression is resumed if necessary.

Now we have all had cases, in which the arrest of parenchymatous oozing proved a most serious task. I remember one case of amputation through the leg, where I almost despaired; the more I ligated the more it bled, surface pressure was of little avail. I hardly knew what to do; douches with boiling water, scalded the surface, but bleeding proceeded. Only after a long siege, by surface pressure and with irrigation of hot water, we were able to control the bleeding, in fact we had to resort to permanent compression by compress bandage that we finally succeeded in controlling the hemorrhage. I was anxious afterward to ascertain the condition of the tissues, that would satisfactorily account for this obstinate parenchymatous oozing. I found in the tissue subjected to microscopic examination, numerous encapsulated trichina that had wrought serious changes in the structure of the vessels and other tissues, and I am firmly convinced, that in many of these cases that will tax your patience and skill in this most important part of your operative work, you will find some tissue lesions that will account satisfactorily for the obstinacy of the parenchymatous oozing. Remember the important tissues concerned on the line of section made through the limb. I have attended to the nerve, I have ligated the arteries, I have ligated at the same time the large veins; the parenchymatous oozing has ceased, now I wish to protect as far as I can the most important anatomical constituents of the line of section, the vessels and the medullary tissue against the deleterious

effects of suppuration, should such a complication arise in this case. I will ask for a catgut suture, in order to take special care in protecting the ends of the blood vessels, because in the event of suppuration the ligated stump of the artery might separate and secondary hemorrhage would be almost sure to follow. I wish to bury, from the surface of the wound, the ligated blood vessels with a buried suture. I do not place very much stress on this being carried out in practice, but where time permits, and in debilitated patients, this is an excellent precaution. You notice that I am taking a deep suture, which entirely buries the arterial stump; I have protected the end of these blood vessels against the immediate effects of traumatic infection, and secondary infection from the surface of the wound that might occur later. I now wish to protect that most sensitive of all structures, to infection with pus microbe, the medullary tissue. It is fortunate for pathologists and surgeons that we are now in possession as a nation, of the rich pathological collection of necrosed bone from amputated stumps, harvested during the last war of the rebellion. Such specimens after amputation are now rarely obtained owing to the effective wound treatment that is now almost universally adopted. It is this traumatic osteomyelitis which so frequently resulted in pyemia and death, it is this traumatic osteomyelitis that yielded the large collection of specimens of necrosed bone. I close the medullary canal by bringing over it the periosteal flap which is again stitched with catgut sutures. Preservation of the periosteum and securing and maintaining an aseptic condition of the wound furnish the most reliable safeguards against osteomyelitis, necrosis and pyaemia. One of the trying conditions after an amputation through the thigh, is the tendency of the bone to project through the soft parts, giving a painful and often useless stump and often making re-amputation necessary. This follows either in consequence of the flaps having been made short or as the result of violent and prolonged course of muscular contractions. We have divided here, some of the strongest muscles in the body, the muscles that have lost their anchorage below, they seek a point of attachment above, consequently there is a tendency for the bone to project. In order



to guard, as far as we can, against this condition, I now resort to the second row of buried sutures, the muscles will be supplied with a temporary point of anchorage. We will make for them for the time being, a point of attachment below. I now make a row of muscle sutures not expecting that these sutures will bring the muscles over the sawn surface of the bone and keep them there permanently, that is not my intention, I could not do so if I wished, because nature's resources here will step in later and undo what I have done. You will always find in an old stump, all the muscles covering it that are placed over the bone intentionally, at the time of the operation, have wasted away by a gradual process, by inactivity and pressure atrophy. But what I do wish to secure for the next three or four weeks, until the process of healing has been completed, is to supply the muscles with a support below, a support that later will be removed spontaneously. The external wound will be closed throughout with silk sutures, that after the process of healing has been completed and the stump has become conical, that the scar will be above and behind the point of pressure. We are dealing now with a very large wound, there will be considerable primary wound secretion; the hospital surroundings here are not the very best, the patient is debilitated by disease and it will become necessary to establish tubular drainage, in the other case we attempt to gain this object by a capillary drain. Here I will drain by making a small button-hole in the middle of the base of the posterior flap, I prefer to do this, rather than drain from the angles of the wounds as I desire to obtain primary healing of the amputation wound throughout, at the same time the drainage will be at the most dependent point where it will prove most effective. The flaps will be stitched in the usual manner and the operation wound closed throughout. In the dressing it is important to again make use of compression as a means of guarding against subsequent parenchymatous oozing during the period of reaction, by making the antiseptic hygroscopic dressing copious, so that it will not only prove useful in absorbing and disinfecting the primary wound secretions but will prove beneficial by exerting a continuous equable elastic compression, which

not only guards against hemorrhage, but constitutes at the same time the best known means in securing accurate apposition between the wound surfaces. The stump will be supported by a hollow posterior splint and will be kept in an elevated position for at least twelve hours.





